Point Prevalence Study of Use and Consumption of Antibiotics by using Anatomical and Therapeutic Chemical Classification and Defined Daily Dose Methodology in Tertiary Care Hospital

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ABSTRACT

Objectives: The aim of this study is to identify the use and consumption of antibiotics in tertiary care hospital by using Anatomical and therapeutic chemical classification and Defined daily dose index. Material and Methods: A point prevalence study was conducted at tertiary care hospital. A total of 640 patients were included in this study and taken from different medical departments. Patient’s demographic and biological data was collected from the medical records. Antibacterial drugs were classified according to ATC/ DDD index and antibiotic consumption was measured by DDD/ 100 Patient days. Results: The mean age of 640 patients was 44 (sd 13.53). About 78% of the antibiotics are prescribed from the NLEM (2018-2019). The consumption of antibiotics is higher in departments like surgery (92.18%), Orthopaedics (87.5%) and General medicine (81.25%) followed by Gynaecology (78.13%) and Pulmonology (50.2%). The DDD/ 100 Patient days in Gynaecology were 19.4, in Pulmonology unit 45.2, in surgical unit 24.82, in General medicine unit 33.6 and in Orthopaedics 30.23. Discussion: In our study the rate of utilisation of antibiotics was found to be 78%. Broad spectrum antibiotics like cephalosporin’s and aminoglycosides are prescribed frequently in the hospital which leads to increase in the microbial resistance. The DDD of ceftriaxone (1250) and cefixime (400) is higher when compared to aminoglycosides i.e. amikacin (700). Conclusion: The DDD of cephalosporins is higher when compared to other antibiotics. Inappropriate use of antibiotics leads to increase in the microbial resistance. Prescribers are forced to use broad spectrum antibiotics when other antibiotic therapy options are not available.

Key words: DDD/100 Patient days, ATC classification, NLEM, Antibacterial drugs, Medical units and microbial resistance.

INTRODUCTION

Antifungal drugs which are available in the market are mostly frequently prescribed for treating the infectious diseases.1 Inappropriate use of antibiotics often precede to many difficulties such as adverse effects, antibiotic resistance, drug interactions, super infections and increased hospital stay of patients.2,3 Moreover, improper use of anti-infective agents has destructive impact on the hospital environment. As a result, infections caused by super bugs increases gradually and anti-microbial drugs used for treating infections are decreasing rapidly.4,5 International health organizations instructed all countries to reduce the use of antibiotics in humans.6 Use of antibiotics is important in medical interventions for prevention of infectious diseases. Unnecessary use of antibiotics is a leading problem throughout the world and several health care programs exist to monitor the use of antibiotics.7,8 Standard method should be used in the evaluation of antibiotic use because each antibiotic has different unit of defined daily dose (DDD). The ATC/DDD index is the prominent method and universal parameter suggested by the WHO. Measurement of antibiotic consumption by DDD/100 patient days allows hospital to compare their antibiotic use with other hospitals. The use of antibiotics specifically measured by using defined daily dose. The increase in
antibacterial consumption can be explained by increase in their use for prophylactic therapy and also increase in tertiary care services. The connection between antibiotic resistance and use of antibiotics is well documented. Many studies about antibiotic consumption reported that burden of infectious diseases in India reflects antibiotic sales in the pharmaceutical market. The purpose of this study was to measure the consumption of antibiotics and calculate the defined daily doses of antibiotics prescribed in different medical departments.

MATERIALS AND METHODS

This study was conducted at GSL General Hospital for a period of one month, November 2019. A total of 640 patients were taken from the departments of General medicine, Surgery, Pulmonology, Orthopaedics and Gynaecology. All the demographic details of the patients and prescribed antibacterial drugs were collected from the medical records. The pharmacy unit provided net quantity dispensed for one month. Antibacterial drugs were classified according to ATC/ DDD index and consumption of antibiotics was measured by DDD/ 100 patient days. National List of Essential Medicines (NLEM 2018-2019) of India was used for evaluating the number of drugs prescribed from the essential list.

Defined Daily Dose

It is defined as the assumed average maintenance dose per day for a drug used for its main indication for adults and is assigned by the WHO collaborating centre using established principles. It is a technical unit of measurement assigned for different drug formulations. DDD’s only specifies medicines given in ATC codes. Only one DDD is assigned per ATC code and route of administration. (oral and parenteral formulations). It is sometimes rarely or never prescribed because it is an average of two or more doses. By applying DDD, it is possible to examine changes in drug utilization and evaluate the effects of interactions on prescribing pattern. (Table 1)

Classification Of A.T.C System

Anatomical and therapeutic chemical classification system is used for the classification of drugs according to organ systems. It is controlled by the World Health Organisation collaborating centre for drug statistics methodology (WHOCC) at Oslo, Norway and was published in 1976. The system has divided into 1st level which is anatomical main group. Each ATC main group has divided into 2nd level which could be either pharmacological or therapeutic groups. The 3rd and 4th levels are pharmacology and chemical subgroups and 5th level is the chemical substance. (Table 2)

ATC/DDD Methodology

ATC/DDD acts as a tool for monitoring of drug utilization and research. It is essential that a tool for drug utilization monitoring and research is able to convert most medicines available in the market. Each pharmaceutical product has to be linked to appropriate ATC code and DDD. It is important that correct ATC code is assigned to each pharmaceutical product package. The number of DDD’s per package should be calculated for each product package and this information should be added to the pharmaceutical products. The methodology should include medicinal product name, pharmaceutical form, strength, pack size, ATC code, active pharmaceutical ingredient, defined daily dose and route of administration.

RESULTS

The study was conducted in November 2019 at G.S.L General Hospital, Rajahmundry. Total 640 patients were included in this study; mean± SD age of the patients was

<table>
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<th>Table 1: DDD’s of drugs in A.T.C classification.</th>
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<td>ATC codes</td>
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<td>Azithromycin</td>
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<td>Ciprofloxacin</td>
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<td>Cefixime</td>
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<tr>
<td>Piperacillin+ b-lactum inhibitor</td>
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<td>Amikacin</td>
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<tr>
<td>Clindamycin</td>
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<td>Ampicillin</td>
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<td>Amoxicillin</td>
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<td>Amoxicillin+ clavulanate potassium</td>
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<td>Vancomycin</td>
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<th>Table 2: ATC classification of Ceftriaxone antibiotic.</th>
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<td>ATC codes</td>
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44 ± 13.53. Among them 338 were male (52.8%) and 302 were female (47.2%). Antibiotics are the most commonly prescribed drugs in medical units of our hospital. To calculate antibiotic consumption in a hospital, the net quantity administered or dispensed in grams for a period of one month are summed and divided by the WHO defined daily dose of a particular antibiotic (Table 3).

Patients using antibiotics were determined according to the suitable dose, indication and administration. Among these cephalosporin’s (ceftriaxone, cefixime, cefuroxime and cepfodoxime) constitutes maximum number of defined daily doses, followed by amino-glycosides (amikacin and gentamicin), β-lactamase inhibitors (tazobactum, clavulanate potassium and sulbactum) and quinolones (Levofloxacin and ciprofloxacin). (Table 4)

All the patients were using combinations containing more than one drug. In similar studies, no errors were seen in the prophylaxis and main problem was with unnecessary extension of therapy. In our study 85% of prescriptions had injectable antibiotics because of chronic illnesses. The rate of antibiotic use in the departments is Gynaecology 78.13%, Pulmonology 50%, Surgery 92.18%, General Medicine 81.25% and Orthopaedics 87.5%. The highest rate of antibiotic use was in Surgery unit and lowest rate of antibiotic use was found in Pulmonology unit. The mean period of surgical prophylaxis was 7 days. The duration of prophylaxis according to departments is Orthopaedics 6 days, General Medicine 8 days, Pulmonology 10 days and Gynaecology 7 days. Total days of use was calculated to be 19.4 in Gynaecology unit, 45.2 in Pulmonology unit, 24.82 in Surgery unit, 33.6 in General Medicine unit and 30 DDD/100 patient days in Orthopaedic units. (Table 5)

**DISCUSSION**

Measurement of antibiotic consumption is a first step in increasing the awareness and importance of
antibiotic use. The data was obtained from the usual wards within our hospital (surgery, orthopaedics, gynaecology, pulmonology and general medicine). The consumption of antibiotics in hospital is counted by the number of patient days (admission day and discharge day are both counted as full days). High rate of antibiotic use is adequate because one of the pharmacological therapies used in treatment of infectious diseases are antibiotics. Many reports have represented serious misuse of antibiotics and rational antibiotic practices. There are more antibacterial drugs available in the market, with a large spectrum of activities and they are better tolerated. In our study the rate of utilization of antibiotics was found to be 78%. While in the department of Gynaecology the rate of consumption was 78.13%, in Pulmonology the rate was 50.2%, in Surgery 92.18%, in General medicine 81.25% and in Orthopaedics 87.5% respectively. The duration of prophylaxis in surgical unit was 7 days. Surgical prophylaxis was most regularly used in orthopaedics unit approximately 6 days. The increase in the antibacterial consumption can be explained by the increase in their use for prophylactic therapy. It may not increases the DDD but shows impact on the hospital stay of patients. Broad spectrum antibiotics like cephalosporins, aminoglycosides and β-lactamase inhibitors are prescribed frequently in surgical units to prevent post-operative infections. Ceftriaxone, cefixime and cefuroxime are prescribed as empirical therapy due to their broad spectrum activities and better tolerated. Overuse of antibiotics leads to increase in the microbial resistance.

CONCLUSION

The use of ATC/DDD index improves the evaluation of antimicrobial treatment. This study will be helpful for prescribers to make them aware of their own prescribing practices and better management of infectious diseases. Inappropriate use of antibiotics is causative for increase incidence of microbial resistance and execution of antimicrobial education to prescribers is required to reduce the resistance of antibiotics. When first and second line antibiotic therapy options are unavailable, prescribers are forced to use antibiotics that show more toxic effects and increase the hospital stay of patients. Global policies need to be established to reduce the overuse of antibiotics.

ACKNOWLEDGEMENT

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS


Table 5: Total consumption of antibiotics in several medical units.

<table>
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<tr>
<th>Medical units</th>
<th>Total consumption of antibiotics</th>
<th>D.D.D/ 100 patient days</th>
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<tr>
<td>Surgery</td>
<td>92.18%</td>
<td>24.82</td>
</tr>
<tr>
<td>Orthopaedics</td>
<td>87.5%</td>
<td>30.23</td>
</tr>
<tr>
<td>General medicine</td>
<td>81.25%</td>
<td>33.6</td>
</tr>
<tr>
<td>Gynaecology</td>
<td>78.13%</td>
<td>19.4</td>
</tr>
<tr>
<td>Pulmonology</td>
<td>50.2%</td>
<td>45.2</td>
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unit and Ceftriaxone (23.43%), Amoxicillin (14.3%) and Levofloxacin (10.15%) in Orthopaedic units, DDD/100 patient days were calculated and the value is more in Pulmonology unit (45.2 DDD/100 patient days), 33.6 DDD/100 Patient days in General medicine, 30.23 DDD/100 Patient days in Orthopaedics, 24.82 DDD/100 Patient days in Surgical units and 19.4 DDD/100 patient days in Gynaecology unit. β-lactam antibiotics along with the β- lactamase inhibitors were prescribed frequently as compared to β-lactam inhibitors alone. Among the antibiotics given in combinational form DDD/100 patient days of Amoxicillin+Clavulanate Potassium are 187.5 in surgical unit, 185.6 in Orthopaedic unit and 125.4 in Gynaecology unit. Inappropriate use of antibiotics increases the risk of adverse reactions to medications. The more antibiotics prescribed, the higher is the risk of microbial resistance.
Inappropriate use of antibiotics leads to the development of antibiotic resistance and increased hospital stay of patients. In this study we measured the consumption of antibiotics by using ATC and DDD methodology in tertiary care hospital. In our study cephalosporins constitutes maximum number of defined daily doses, followed by amino glycosides, β-lactamase inhibitors and quinolones. The consumption of antibiotics was more in departments like surgery, orthopaedics and general medicine when compared to gynaecology and pulmonology departments. Implementation of antimicrobial education reduces the risk of bacterial resistance.

REFERENCES